

REMARKS

Claims 1-20 are pending in this application. Claims 1 and 11 are independent claims. Claims 11-16 were previously withdrawn from consideration.

Claims 1-10 and 17-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 3,356,748 to Drinkard et al. (hereinafter also referred to as “Drinkard”) in view of U.S. Patent No. 6,242,633 to Fischer et al.¹ (hereinafter also referred to as “Fischer”) and International Publication No. WO 02/26698² to Jungkamp et al. (hereinafter also referred to as “Jungkamp”). The cited references do not render obvious the present invention.

The present invention describes a process for preparing 3-pentenitrile by isomerizing streams comprising 2-methyl-3-butenitrile. This forms a stream 1 which comprises an isomerization catalyst, 2-methyl-3-butenitrile, 3-pentenitrile and (Z)-2-methyl-2-butenitrile. Later in the process, 3-pentenitrile is obtained by distillation, 2-methyl-3-butenitrile is recycled and a fraction in which (Z)-2-methyl-2-butenitrile is enriched is discharged.

The process according to the invention differs essentially in the measures in (c) of claim 1. The measures in (c) of claim 1 are not described in any of the citations and cannot be derived from the citations or combination thereof without exercising inventive skill. In particular, claim 1 recites distilling stream 2 at a bottom temperature of 40 to 180°C and a pressure of 10 mbar to 500 mbar. It is evident from step (c) that the distillation of a stream 2 affords a top product 4 in which (Z)-2-methyl-2-butenitrile is enriched compared to stream 2, based on the sum of all pentenenitriles. The bottom product obtained is a stream 5 in which 3-pentenitrile + 2-methyl-3-butenitrile is enriched compared to stream 2, based on the sum of all pentenenitriles.

Removal of as much as possible (Z)-2-methyl-2-butenitrile is necessary since it otherwise accumulates in the 2-methyl-3-butenitrile because the boiling point difference from 2-methyl-3-butenitrile is too small.

¹ Fisher et al. is owned by BASF AG and names an inventor in common to the present application.

² WO 02/26698 is also owned by BASF AG and also names co-inventors common to the present application.

US Patent 3,865,666, cited in the present application, states that the distillative removal of 2-methyl-2-butenitrile (2M2BN) from mixtures with 3-pentenitrile and 2-methyl-3-butenitrile (2M3BN) presents difficulties (please see column 1, lines 26 to 29). Therefore, US Patent 3,865,865 proposes reacting the reaction mixture from the isomerization with aqueous alkali metal sulfite/alkali metal bisulfite solutions to give adducts which can be extracted from the reaction mixture with water. This process is very complex since it constitutes an additional process step.

As appreciated by the examiner, Drinkard et al. fail to disclose the crucial distillation steps (c) discussed above and (d), which recites distilling stream 5 at a pressure of 0.001 bar to 100 bar to obtain a stream 6 as the bottom product which comprises 3-pentenitrile and a stream 7 as the top product which comprises 2-methyl-3-butenitrile, the (Z)-2-methyl-2-butenitrile-depleted 2-methyl-3-butenitrile being recycled to step (a). By contrast to the present invention, Drinkard et al. relate to the isomerization of 2-methyl-3-butenitrile with a $\text{Ni} [\text{P} (\text{OC}_2\text{H}_5)_3]_4$ catalyst, so as to yield a liquid product stream which is then vacuum-distilled. The distillate includes 2-methyl-3-butene nitrile, 3-pentenitrile, 2-methyl-2-butenitrile and 4-pentenitrile. The bottom stream composition is not further described, but one would expect it to contain the catalytic system and possible solvents.

As mentioned above, the subject matter of present claim 1 clearly differs from Drinkard et al., i.e., by the above-recited distillation steps (c) and (d). This presently claimed combination of features is neither known nor can be directly derived from Drinkard et al., either alone or in combination with Fischer et al. and Jungkamp et al. In particular, the Office has not shown that there would be an apparent reason to modify Drinkard et al. with Fischer et al. and Jungkamp et al.³ Fischer et al. do not overcome the above deficiencies of Drinkard et al. with respect to rendering unpatentable the present invention. Fischer et al. fail to suggest the crucial distillation steps (c) and (d) or the recited recycling according to the present invention. Fischer et al. were relied upon for a disclosure of nickel isomerization catalysts.

³ In fact, the conclusion in the International Preliminary Report on Patentability (copy attached) was that the claims were novel, inventive and had industrial utility.

WO 02/26698 to Jungkamp et al. does not overcome the above deficiencies of Drinkard et al. with respect to rendering unpatentable the present invention.

Jungkamp describes the distillative separation of pentenenitrile isomers in the presence of a liquid diluent, especially water. The diluent forms azeotropes with the pentenenitrile isomers.

Table 1 below comprises the distillation results of three pentenenitrile isomer pairs with water at standard pressure and a return ratio of 1 to 5 (ratio of removal to return stream). The isomeric ratio of the starting isomer mixture is compared with the isomeric ratio of the top product obtained in the distillation (examples 1 to 3). In all three examples, there is a rise in the content in top fraction of the pentenenitrile isomers to be removed, trans-2-pentenenitrile, trans-3-pentenenitrile and (E)-2-methyl-2-butenitrile.

In comparative examples 1 to 3, no water was added. Distillation was likewise effected at standard pressure. Without the addition of water, the amount of the pentenenitrile isomers to be removed in the top product worsened in all three cases.

Jungkamp states that the distillation can be performed at a pressure in the range from 1 to 200/kPa (0.01 — 2 bar), preferably 50 to 100 kPa (0.5 to 1 bar), especially at standard pressure (Jungkamp, page 5 lines 24 to 26). However, the person skilled in the art would not have performed the distillation under reduced pressure for the following reasons:

- a) the preferred distillation at standard pressure leads away from working under reduced pressure
- b) there are no working examples in Jungkarinp for working under reduced pressure
- c) the distillative separation of (Z)-2-methyl-2-butenitrile and 2-methyl-3-butenitrile is not described in Jungkamp.

Since there is no need to distill off any water, there is a decrease in the energy costs which arise in the inventive isomer separation.

The pentenenitrile isomers are used exclusively in the hydrocyanation of pentenenitriles with hydrogen cyanide to give adiponitrile. Hydrogen cyanide and the nickel(0) complexes used as catalysts are extremely water-sensitive. After the inventive distillative pentenenitrile isomer separation without addition of water, drying of the pentenenitriles can be dispensed with.

Examples are compiled below regarding the pressure dependence of the distillative (Z)-2-methyl-2-butenitrile/2-methyl-3-butenitrile separation (please see WO 2005/73179, pages 23-24).

The following abbreviations are used:

T3PN	trans-3-pentenenitrile
C3PN	cis-3-pentenenitrile
4PN	4-pentenenitrile
2M3BN	2-methyl-3-butenitrile
T2PN	trans-2-pentenenitrile
C2PN	cis-2-pentenenitrile
E2M2BN	(E)-2-methyl-2-butenitrile
Z2M2BN	(Z)-2-methyl-2-butenitrile
VSN	valeronitrile
VCH	4-vinylcyclohexene

The separation of the starting mixture comprising trans-3-pentenenitrile, 2-methyl-3-butenitrile and (Z)-2-methyl-2-butenitrile as main components (Table 1) is performed in a distillation column with evaporator, total condenser and reflux divider. The distillation column

has 15 theoretical plants. The return ratio $m(\text{removal})/r_n(\text{return to column})$ is 50. The feed into the evaporator is at 10 kg/h into the bottom of the column; the removal at the top is at 0.05 kg/h.

Table 1

Constituent	Feed, % by weight
T3PN	58
C3PN	1
4PN	1
2M3BN	21
T2PN	0
C2PN	1
E2M2BN	1
Z2M2BN	16
VSN	0
VCH	1

Table 2

Example	Pressure (bar)	Bottom temperature °C	Top temperature °C	2M3BN in tops % by weight	Z2M2BN in tops % by weight
1	1.000	133	119	23	77
2	0.500	110	97	22	77
3	0.200	84	71	21	78
4	0.100	68	55	20	79
5	0.050	53	40	19	80
6	0.020	38	22	17	82

Examples 1 to 6 (Table 2) show that, with the same return ratio and same removal rates, the lower the pressure established in the column, the higher the efficiency of the separation of 2-methyl-3-butenitrile and (Z)-2-methyl-2-butenitrile; at lower pressure, the residual content of 2-methyl-3-butenitrile in the top draw decreases and the content of the (Z)-2-methyl-2-butenitrile to be removed in the tops increases.

Examples in the specification demonstrate unexpected results achievable by the present invention. Along these lines, the claimed process provides low losses of 2-methyl-3 butenenitrile during distillative separation of (Z) 2-methyl-2- butenenitrile (cf. example 1-4 of the present specification). This is surprising since the boiling points of both compounds differ only slightly

from each other.

Moreover, the relative antiquity of Drinkard et al. is further indicia of the non-obviousness of the present invention. Along these lines, please see *In re Adams* 148 USPQ 743 (CCPA, 1966) and *In re Lechen*, 125 USPQ 396 (CCPA, 1960).

In conjunction with interpreting 35 U.S.C. §103 under *Graham V. John Deere*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966) and *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), the initial burden is on the Patent Office to provide some apparent reason or suggestion of the desirability of doing what the inventor did, i.e. the Patent Office must establish a *prima facie* case of obviousness. To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention, or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. Moreover, MPEP, § 706.02(j), states that "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. Also, please see *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985).

In addition, the prior art reference (or references, when combined) must teach or suggest all of the claim limitations.

The mere fact that cited art may be modified in the manner suggested in the Office Action does not make this modification obvious, unless the cited art suggests the desirability of the modification or impliedly suggests the claimed invention, or the Examiner has presented a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. No such suggestion appears in the cited art in this matter nor has a convincing line of reasoning been presented in this case. The Examiner's attention is kindly directed to *KSR Int'l Co. v. Teleflex, Inc.*, supra; *In re Dembiczak et al.*, 50 USPQ2d.1614 (Fed. Cir. 1999), *In re Gordon*, 221 USPQ 1125 (Fed. Cir. 1984), *In re*

Laskowski, 10 USPQ2d, 1397 (Fed. Cir. 1989) and *In re Fritch*, 23, USPQ2d, 1780 (Fed. Cir. 1992).

Furthermore, the cited art lacks the necessary direction or incentive to those of ordinary skill in the art to render a rejection under 35 USC 103 sustainable. The cited art fails to provide the degree of predictability of success of achieving the properties attained by the present invention needed to have a rejection under 35 U.S.C. 103 sustained. See *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), *Diversitech Corp. v. Century Steps, Inc.*, 7 USPQ2d 1315 (Fed. Cir. 1988), *In re Mercier*, 187 USPQ 774 (CCPA 1975) and *In re Naylor*, 152 USPQ 106 (CCPA 1966). In particular, the claimed process provides low losses of 2-methyl-3 butenenitrile during distillative separation of (Z) 2-methyl-2- butenenitrile (cf. example 1-4 of the present specification). This is quite surprising since the boiling points of both compounds are only slightly different.

Moreover, the properties of the subject matter and improvements which are inherent in the claimed subject matter and disclosed in the specification are to be considered when evaluating the question of obviousness under 35 USC 103. See *KSR Int'l Co. v. Teleflex*, *supra*, *Gillette Co. v. S.C. Johnson & Son, Inc.*, 16 USPQ2d 1923 (Fed. Cir. 1990), *In re Antonie*, 195 USPQ 6 (CCPA 1977), *In re Estes*, 164 USPQ 519 (CCPA 1970), and *In re Papesch*, 137 USPQ 43 (CCPA 1963).

No property can be ignored in determining patentability and comparing the claimed invention to the prior art. Along these lines, see *In re Papesch*, *supra*, *In re Burt et al*, 148 USPQ 548 (CCPA 1966), *In re Ward*, 141 USPQ 227 (CCPA 1964), and *In re Cescon*, 177 USPQ 264 (CCPA 1973).

Applicants may not have presented all possible arguments or have refuted the characterizations of either the claims or the prior art as found in the Office Action. However, the lack of such arguments or refutations is not intended to act as a waiver of such arguments or as concurrence with such characterizations.

In view of the above, consideration and allowance are respectfully solicited.

In the event the Examiner believes an interview might serve in any way to advance the prosecution of this application, the undersigned is available at the telephone number noted below.

The Office is authorized to charge any necessary fees to Deposit Account No. 03-2775, under Order No. 12810-00322-US1 from which the undersigned is authorized to draw.

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